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A SIMPLE DESIGN OF MULTIBAND PATCH ANTENNA FOR RFID AND X-BAND FREQUENCY APPLICATIONS

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ABSTRACT

A simple microstrip patch antenna is presented for wireless communication. This Microstrip patch antenna design that covers the bandwidth for passive and active RFID tags identification and X band frequency. The parameters of the designed antenna are presented. The operating bands are simulated and analyzed by Ansoft HFSS 14 with the criterion of return loss S11 less than -10dB. This simulation is done by using HFSS 14 software.

Keywords: *patch antenna, multi-band, multi-standard, wireless communications.*

I. INTRODUCTION

This paper presents a narrow band microstrip patch antenna for wireless communication. A microstrip patch antenna consists of a radiating patch on one side of a dielectric substrate and has a ground plane on the other side. The main radiator is a rectangular patch made up of copper. The advantages of this type of microstrip patch antennas are planar, smaller in size, simple structure, low in cost and easy to be fabricated, etc. thus attractive for wireless applications. Simulation of the antenna and subsequent adjustments of parameters gives apt values for the antenna to work efficiently at low cost especially wireless antenna systems for mobile communications [1]-[2].

Even though these antennas have lot of advantages, it has drawbacks of their narrow bandwidth due to surface wave losses and for better performance we need large patch size [3]-[4]. In order eliminate the large patch size and combining multiple applications on a single antenna, the multiband technique is used.

The different techniques are using to design multiband antenna such as Frequency Selective Surface [5]-[6], folded patch antennas [7], the use of slots [8], use of thick substrate [9], E-shaped patch antenna and compatible feeding [10],[11] and feeding techniques [12] are used to increase the bandwidth of microstrip patch antenna. The size and thickness of feeding patch and dielectric should be taken care and the method of the microstrip line [13], which is easier compared to other methods and gives a good overview of the physical operation antenna, allowed us to obtain an antenna capable of the bandwidth for long read range passive and active RFID tags identification and X band frequency.

II. THE ANTENNA DESIGN

The top view designed antenna is shown in figure 1. The antenna is simulated on an FR4_epoxy substrate of 45 ×70 mm^2 with a dielectric constant 4.4 and thickness of the substrate is 0.8 mm. influence of the side slots on the radiation conductance is taken into account implicitly [14].

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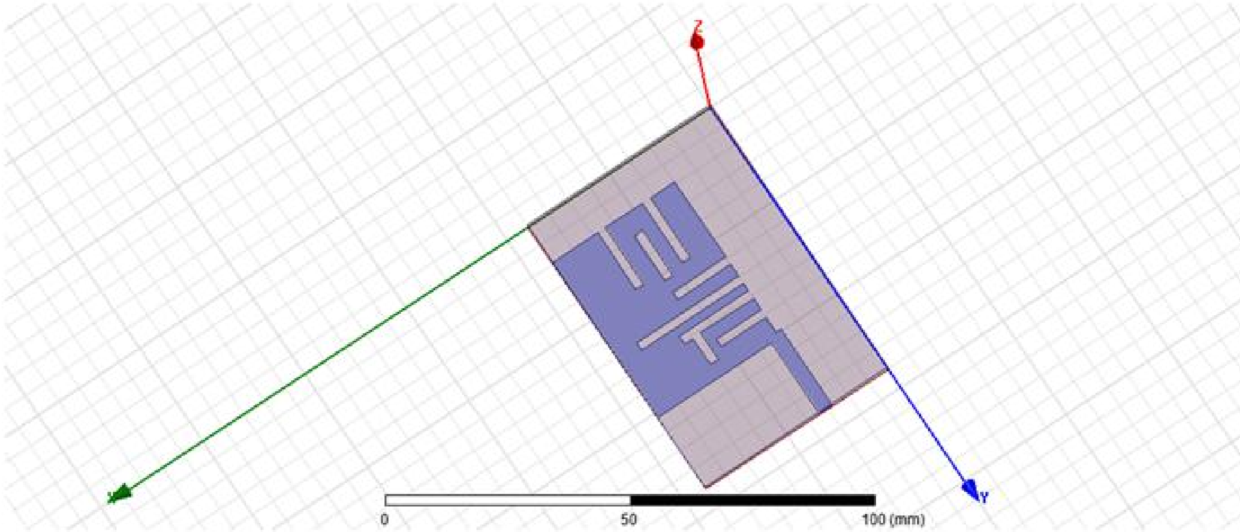

Fig 1 Simulated antenna Structure

The designed antenna resonates frequency band allows us to cover the long read range passive and active RFID tags identification and X band frequency.

III. RESULTS AND DISCUSSION

3.1 Return Loss

An s11 value of "-10 dB" means 10% of the incident power is reflected back towards the source from the antenna under consideration. There is nothing hard and fast about this value - indeed, an antenna will still radiate with an appalling input s11 of only -3 dB (50% incident power reflected), an amplifier with an input s11 of -3dB will still amplify it's input signal - just comparatively inefficiently [since you're throwing away half your signal power before you even get started, and with potential problems at the signal source if it has issues with reflected power at its output. Dielectric constant also plays important role it should be less.

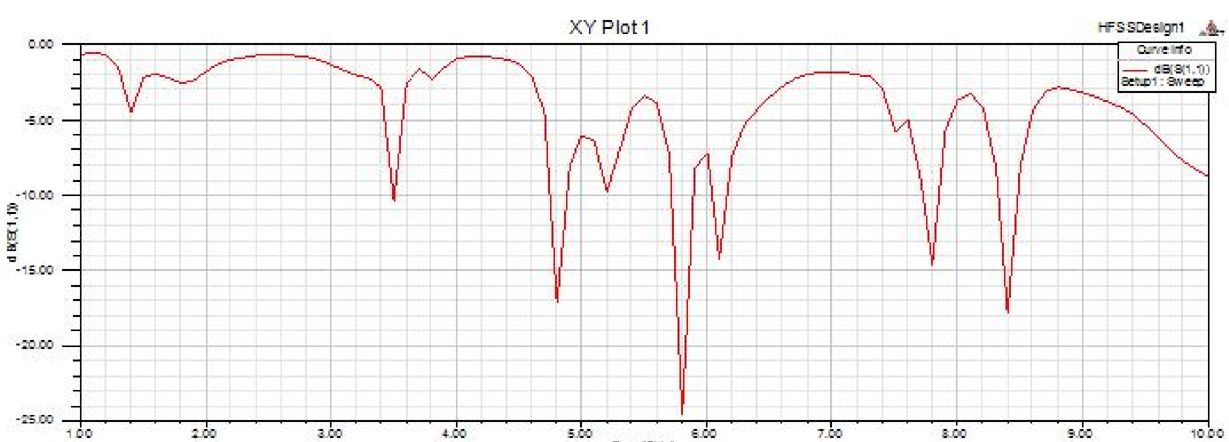

Fig 2 Reflection Coefficient of the simulated Antenna

Figure 2 shows the reflection coefficient of the studied Microstrip patch antenna, obtained from the simulation. It is noted that the resonant is excited with -10dB return loss. For this, the antenna is operating at these resonance frequencies 3.45, 4.8, 5.8.6.05, 7.8 and 8.4 GHz.

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3.2 VSWR

The proposed antenna can cover the long read range passive and active RFID tags identification and X band frequency bands with constraint of VSWR ≤ 2 as shown in figure 3

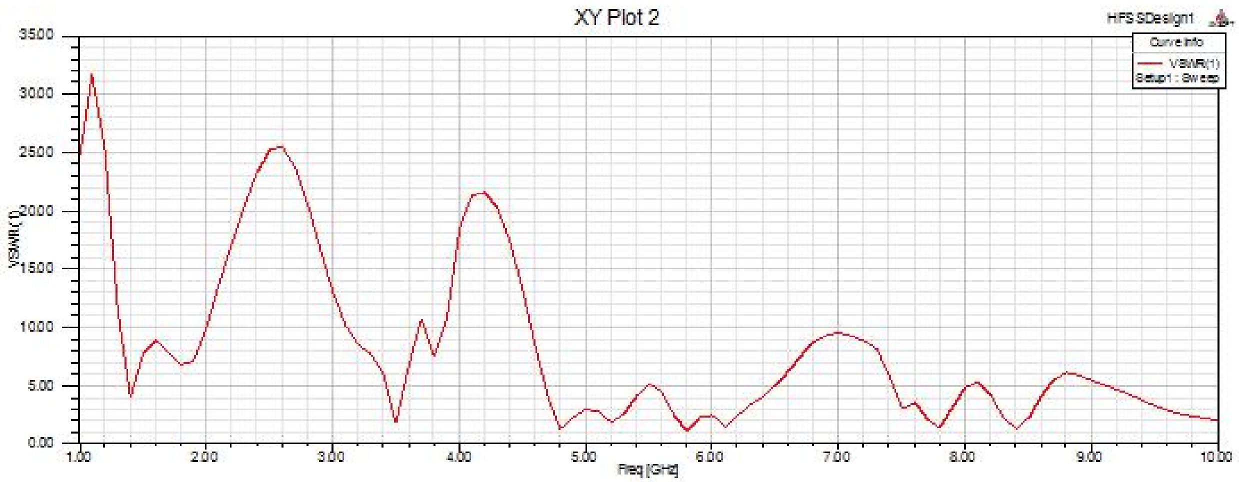

Fig 3 Voltage Standing wave ratio

3.3 Radiation pattern

A radiation pattern defines the variation of the power radiated by an antenna as a function of the direction away from the antenna. This power variation as a function of the arrival angle is observed in the antenna's far field. The elevation pattern of the patch antenna for φ=0° and φ=90° would be important. Figure 4 present the radiation pattern for the proposed patch antenna.

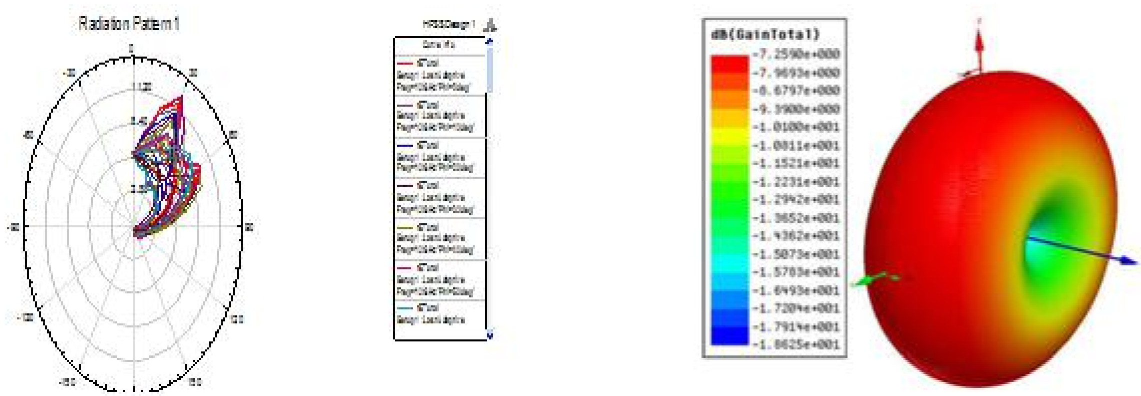

Fig 4 (a) 2D Radiation Pattern, (b) 3D-Gain Total

3.4 E-Field distributions

An electric field is a vector field surrounding an electric charge that exerts force on other charges, attracting or repelling them [15].

Figure 5 shows the electric field distribution. The maximum value of the E-field obtained is 27.78 10^4 V/m

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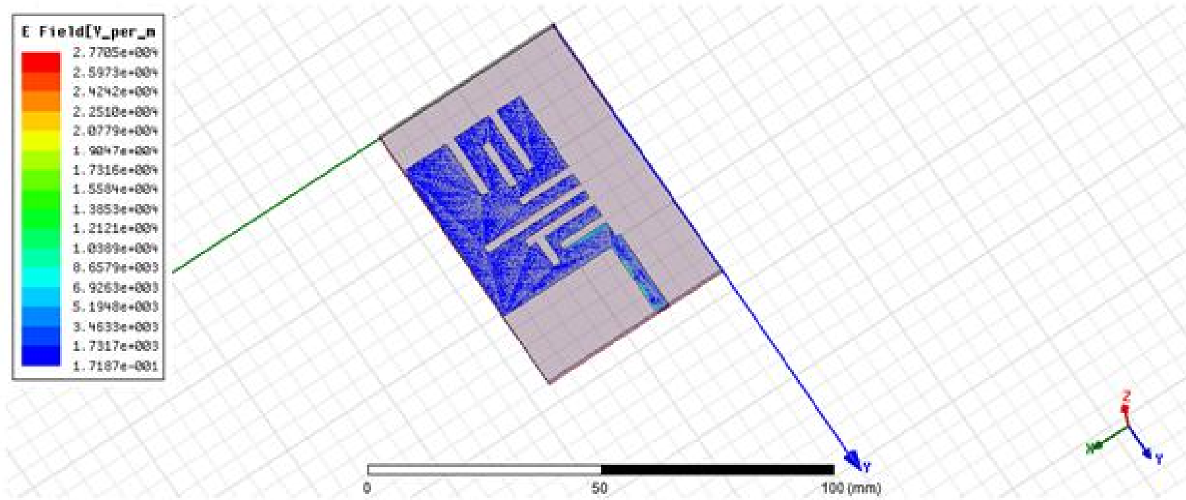

Fig 5 E-field Distribution

3.5 H-Field distributions

It is defined as the measured intensity of a magnetic field at a specific point. Usually expressed in amperes per meter

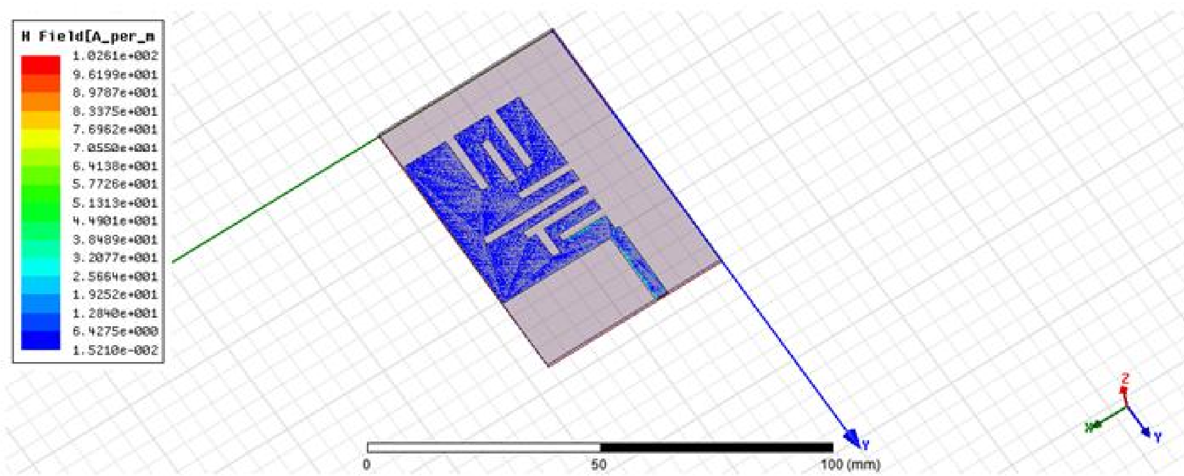

Fig 6 E-field Distribution

The measured intensity of a magnetic field in the patch is shown in Figure 6. The maximum value of the H-field obtained is 10.26.5 A/m.

IV. CONCLUSION

Based on the design and analysis of the microstrip antenna with slots, it is simulated and optimized to cover for long read range passive and active RFID tags identification and X band frequency.

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